INS 93 add C2 add E26

Patent claims

1. A continuous cable processing apparatus having a cable transport apparatus which comprises at least one first and at least one second transport means (A, B; C; 111; 112, 113) for linear transport and holding of a cable (107) along a first transport path (100) definable by the cable axis (106), having at least one knife station (E, F, G, 115) for processing the cable (107) along this transport path (100), the knife station (E, F, G, 115) being arranged between the two transport means (A, B; C; 111; 112, 113) and, before and after the processing of the cable (107), said transport means holding said cable or each holding one of the cable end regions (107a, b), facing one another and created by the knife station, so as to be movable parallel to the first transport path (100) in the longitudinal cable direction, wherein the knife station (E, F, G, 115) and/or at least one of the transport means (A, B; C; 111; 112, 113) is displaceable approximately at right angles or at right angles to the first transport path (100) by means of a motor.

2. The cable processing apparatus as claimed in claim 1, wherein the knife station (E, F, G, 115) for receiving a plurality of tools (3; 3a-h) is formed transversely with respect to the transport path (100) and is displaceable by means of a motor transversely with respect to the transport path (100) so that each tool (3; 3a-h) can be positioned in a working position along the transport path (100), at least two, optionally continuously positionable, holding apparatuses being provided for the tools (3; 3a-h), and the tools (3; 3a-h) being selectable as required from the group consisting of the cable-processing tools, for example, comprising: knives, crimping tools, twisting tools, punching tools, clamping apparatuses, marking apparatuses, grinding apparatuses, etc.

3. The apparatus as claimed in claim 1 or 2, wherein the transport means (A, B; C; 111; 112, 113) each have at least one pair of rollers (A, B; 111) and/or each have one pair of continuous belts (C; 112).

4. The apparatus as claimed in any of the preceding claims, in particular insulation stripping apparatus having at least one pair of tool supports (1, 2) for receiving at least two tools (3), and a tool support feed means (5) for positioning one or other tool (3a, b, c, d) above the first transport path (100) or above an axis (106) along which a cable (107) from which the insulation is to be stripped can be inserted in its feed direction, the tool support feed means (5) being formed for a controlled lateral drive for the controlled sideward displacement of at least one tool support (1, 2) to any desired positions within a working range to the side of the transport path (100) or of the axis (106).

5. The apparatus as claimed in claim 4, wherein the tools (3) are arranged in pairs and have at least two pairs of knives, for example at least one knife at the top and at least one knife at the bottom per pair.

6. The apparatus as claimed in any of the preceding claims, wherein both tool supports (1b, 2b; 1c, 2c) are held on a common support part (8) and are displaceable together therewith.

7. The apparatus as claimed in any of the preceding claims, wherein a separate tool support feed means (5a, b) is coordinated with each tool support (1, 2) so that upper and lower tool positions can be combined.

8. The apparatus as claimed in any of the preceding claims, wherein the tool holders (1, 2) - optionally also independently of one another - are continuously adjustable relative to one another or toward or away from the axis (106).

9. The apparatus as claimed in any of the preceding claims, wherein a guide apparatus (9) (pipe) which can

be swivelled laterally upward or downward is provided, which guide apparatus can be swivelled laterally or preferably upward for increasing the insulation stripping lengths, in order to enable a cable (107) already the other side of the tool (3) to be pushed back against the feed direction without collision.

10. The apparatus as claimed in any of the preceding apparatus claims, wherein the rollers (A, B; 111) or continuous belts (C; 112) located opposite one another across the axis 106 are - preferably continuously - adjustable relative to one another and in particular can be opened and closed in a cable-dependent and feed-controlled manner (so that, for example, a cable (107) arriving is received between opened rollers (A, B; 111) or belts (C; 112) and is transported onward by means of rollers (111) or belts (112) moved toward one another or closed) and/or can be held against one another under a - preferably variable or controllable - contact pressure.

11. The apparatus as claimed in any of the preceding apparatus claims, wherein, in the case of a continuous belt pair (C; 112), the continuous belts (13) are each guided around at least two rollers (111), between which, in the middle region, preferably at least one support roller (14) is arranged for supporting the belt (13), and/or wherein the belts (13) are in the form of a toothed belt on the inside and/or are slip-resistant on the outside.

12. The apparatus as claimed in any of the preceding apparatus claims, wherein the pairs of continuous belts (112) or the rollers (111) or at least one of the belts (13) of the pairs (112) can be removed without replacement and/or can be replaced by, preferably, coated drive rollers (111) or pairs (112) of continuous belts, or the continuous belt pair module (C) can be replaced by roller modules (A, B), and vice versa.

13. The apparatus as claimed in any of the preceding

apparatus claims, wherein at least the upper and/or the lower rollers (111) or continuous belts (112) of a pair of rollers or of a pair of continuous belts, respectively, and/or the upper and lower tool holders (1) are each displaceable transversely with respect to the transport path (100), relative to the opposite part in each case, so that a twisting procedure can be performed on a cable (107) lying in between.

14. The apparatus as claimed in any of the preceding claims, wherein the tool support feed means (5) comprises at least one motor, for example a stepping motor (23), in particular a linear stepping motor, and a programmable microprocessor for the control thereof and/or a cable absence sensor, and/or wherein a plurality of tool support feed means (5) having a plurality of tool supports (1, 2) are arranged along the axis (106).

15. The cable processing apparatus having a drive for a pair of rollers or of belts, as claimed in any of the preceding claims, wherein the rollers (111) or belts (13) opposite one another and belonging to pairs of rollers or of belts (A, B; 111; C; 112) are adjustable relative to one another by means of stepping motors - preferably via spindles, a control having an automatic RESET and/or a programmable circuit and/or at least one pressure sensor for measuring and/or evaluating the contact pressure on the cable (107) being coordinated with the motors.

16. The cable processing apparatus having drive and processing stations, as claimed in any of the preceding claims, wherein a common baseplate is provided, on which drive or feed or tool holders and/or measuring or marking modules can be provided in a mountable or removable or interchangeable manner at predetermined positions along the axis (106).

17. The cable processing apparatus having a roller feed or belt feed, as claimed in any of the preceding

claims, wherein an automatic threading apparatus and/or a measuring apparatus for the tensile load on the cable (107) and/or a dynamic contact pressure means on the feed rollers (111) or feed belts (112), in particular as a function of the tensile load on the cable (107), and/or a cable straightening apparatus and/or a length sensor are furthermore coordinated with the roller feed or belt feed.

18. The cable processing apparatus having a tool support for tool feed, as claimed in any of the preceding claims, wherein an encoder (41) is arranged on an adjusting spindle (18) of the tool support for the tool feed, which encoder, in the operating state, as a function of the drive movement of a drive motor (23; 16) - optionally by comparison with the comparable encoder value on the encoder of this drive (23; 16) - monitors the rotary movement of this adjusting spindle (18) in order to detect completed closing of the tools (3) and to stop the drive movement and to calibrate or to initialize the drive or its encoder, the connection between drive motor (23; 16) and spindle (14) preferably being elastic - in particular coupled via a toothed belt (24). (Fig. 7)

19. A process for operating a cable processing apparatus having tool holders and insertable tools, in particular as claimed in any of the preceding claims, wherein a monitoring member is provided which monitors the open state of the tool holders (1) or of the tools and reduces the drive force of the drive motor (23; 16) shortly before the closing of the latter, so that it brings the tool holder into the closed position with slight force, said position optionally being detected by virtue of the fact that an encoder connected to or integrated with the drive motor (23; 16) loses its steps (of the rotary movement) in spite of the supply of drive energy.

20. The apparatus as claimed in any of claims 1-18,

wherein a control member having a computer is provided, which, in the operating state, after input of the cable diameter and optionally a cable type designation and the desired insulation stripping length, automatically calculates and sets an initial opening of the roller or belt drive (A, B; 111; C; 112) and/or a contact pressure for stripping of long insulation sections or appropriately controls the drives.

21. The cable processing apparatus having a first and a second belt drive for a cable feed, as claimed in any of the preceding claims 1-18 or 20, wherein a gripping apparatus is coordinated with the second belt drive (112b), if required the second belt drive (112b) releasing the cable (107) so that it can be removed by the gripping apparatus.

22. The process for controlling a cable processing apparatus, in particular an apparatus as claimed in any of the preceding claims 1-18 or 20-21 having a program containing a control for controlling the drives of the apparatus, the program comprising program steps coordinated with individual process steps, wherein a plurality of such program steps are combined to form groups of operations, in which the step sequence is predetermined but the control parameters of at least one step are selectable or adjustable, the groups of operations, when called up, triggering program steps which are preprogrammed in such a manner and result in the control of the drives in the step sequence.

23. The process as claimed in claim 22, wherein the individual program or process steps or the control parameters linked therewith can be set to 0 or can be set by desired other parameters via an input unit - preferably under menu control.

24. The process as claimed in either of claims 22-23, wherein a plurality of program groups are combined to form overlapping program groups, and/or wherein the individual program groups are shown as an overview and

subsequently in detail on the display, the display permitting in particular interactive correction of the given values in the individual program steps.

25. The cable processing apparatus as claimed in any of the preceding apparatus claims, in particular as claimed in any of claims 1 to 6, wherein the displaceability of the one or more, preferably two, transport means (A, B; 112; C; 113) permits the parallel displacement of the cable (107) or of at least one cable end (107a, b) from the first transport path (100) to at least the second transport path (102, 103), and wherein a further processing station (16, 17) (for example an external device) is or can be coordinated with the second transport path (102, 103).

26. The apparatus as claimed in claim 25, wherein the further processing station comprises at least one transport or processing station (16, 17), such as, for example, an insulation stripping station, a sawing station, a cutting station, a twisting station, a shaping station, a crimping station or a soldering station, a cable end processing station or a manipulator arm or the like.

27. The apparatus as claimed in claim 25 or 26, wherein at least one transport means (A, B; 111; C; 112, 113), but preferably one each on both sides of the knife station (E, F, G, 115), is guided in a linear guide (110) transversely to the transport path (100) and in particular can be moved by a drive apparatus (111-14), preferably a stepping motor.

28. The apparatus as claimed in any of claims 25 to 27, wherein the drive apparatus (111-14) of each movable transport means (111; 112, 113) and at least one independent transport drive, but preferably one each on both sides of the knife station (E, F, G, 115), is connected to a common control which preferably also controls the knife station (E, F, G, 115) and the one or more further processing stations (16, 17), so that

all longitudinal and transverse movements can be performed in a coordinated and time-optimized manner, in particular in synchronization with the processing steps.

29. The apparatus as claimed in any of the preceding apparatus claims, wherein the two transport means (112) are connected to one another by a common motor-controlled actuator (101) so that, preferably, the transverse adjustment of one transport means (112a) inevitably results in a diametrically opposite lateral adjustment of the other transport means (112b). (Fig. 23, 25, 26)

30. The apparatus as claimed in any of the preceding claims 1-28, wherein at least one transport means (112a) is connected to the knife station (115) or to at least one tool support by a common, motor-controlled actuator (104) so that, preferably, the transverse adjustment of one transport means (112b) inevitably results in a diametrically opposite transverse adjustment of the knife station (115) or of the tool support. (Fig. 24)

31. The apparatus as claimed in any of the preceding claims, wherein the knife station comprises a rotatable knife, or wherein a second knife station having a rotatable knife (030), whose axis of rotation is along the transport path or along one of the transport paths (100, 102, 103), is provided in addition to the knife station.

32. A process for stripping the insulation of a cable (107) by means of an apparatus as claimed in any of the preceding claims, in particular as claimed in claim 31, wherein the cable (107) is held (clamped) in a centered manner on at least two sides, preferably both sides of the knife (030), during the incision with the knife (030), at least one holding or clamping point being arranged in the immediate vicinity of the knife (030), the knife feed being coupled with the feed for

the clamping and/or centering apparatus or the clamping feed being separate from the knife feed, and at least one transport means - preferably both transport means - or a clamping and/or centering apparatus being held nonrotationally or the clamping and/or centering apparatus (111; 112) closest to the knife rotating together with the latter.

33. The apparatus as claimed in any of the preceding apparatus claims, wherein the clamping and/or centering apparatus (A, B; 111, C; 112; 013) comprises at least two - preferably four clamping and/or centering jaws (111; 112; 013) which lie in a plane and each have a retaining surface, which retaining surfaces are at least approximately perpendicular to the radial plane with the cable (107) and are formed in such a way that closing of the jaws (A, B; 111; C; 112; 013) to approximately zero cable diameter is possible.

34. The insulation stripping apparatus as claimed in either of claims 33 and 34, wherein the cutting apparatus comprises two knife jaws (030) which lie in a plane and each have a cutting edge, which cutting edges are formed at least approximately parallel to one tangential plane each of the cable (107) and can be closed to zero and can be advanced to give different initial contact points at the edge with the cable sheath, depending on the cable diameter.

35. The apparatus as claimed in any of the preceding apparatus claims, wherein the knife station, in particular the cutting apparatus and at least one centering closing apparatus (A, B; 111, C; 112, 013) are in the form of an automatic processing module (rotating box) (057) which is removably mounted on a continuous cable processing machine (058), the module (057) preferably being connected to the frame of the continuous cable processing machine (058) by means of a hinge (059) so that it can be swivelled out of an axial working position - relative to the cable (107) - into a

mounting position inclined relative thereto.

36. The apparatus as claimed in any of the preceding apparatus claims, wherein the centering jaws (013) are L-shaped in section so that their retaining surfaces cover a relatively large axial range of a cable sheath and their ends project directly adjacent to the knife (030).

37. The apparatus as claimed in any of the preceding apparatus claims, wherein, for controlling the rotatable knives (030) along the transport path (100), displaceable rods (060) are provided which have, in the region of the knife holders (015), wedge surfaces (016) which cooperate with diametrically opposite formations of the knife holder (015), the rods (060) coming into contact at the other hand with a wedge clamp (018) which is displaceable along the transport path (100) by nonrotatable actuators (061).

38. The apparatus as claimed in any of the preceding apparatus claims, wherein a length meter in the form of an approximately force-free or contactless direct or indirect, for example mechanical or optical, sensor is provided for scanning the cable surface, which length meter optionally measures parallel to step measurements in the drives of the transport means so that each length measurement is quality-controlled.

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